Ferranti

microspot

CATHODE RAY TUBES

24in. All-Glass Flat-Faced CRT

★ The world's largest Flat-faced All-glass Cathode Ray Tubes.

★ Aluminised Screens available with High Brightness and Anti-flicker Phosphors.

★ Armoured Glass Face Plate bonded to the tube face.

★ Designed for Large Area Direct-view Display Systems, e.g. Radar and Alpha-numeric applications.

LIST ESB 381266 December 1966

24in. All-Glass Flat-Faced Cathode Ray Tubes

Introduction

The 24/10 and 24/48 are all-glass cathode ray tubes with a nominal face-plate diameter of 600mm. (24″) and are specifically designed for use in large area direct-view display applications. The tubes have a substantially flat face whose radius of curvature is greater than five times the diameter of the face giving a chord height (the height of the centre of the face above the edge) of 9mm. (0·35″). The optical design of the face-plate assembly has been optimised to enable a very high degree of contrast to be obtained.

The tubes are intrinsically safe partly because of the armoured glass face plate which is bonded to the tube face and partly because of the special treatment applied to the cone in order to increase the physical strength. These tubes can also be supplied fitted with a Solidex implosion guard.

Features

Compared with metal-coned tubes, cathode ray tubes with all-glass envelopes offer a number of major advantages which are summarised below.

The all-glass envelope does not require any insulation to be provided between the tube and its associated equipment. Thus, the 24/10 and 24/48 tubes can be mounted so that their face-plates are flush with the front surface of the panel. With a metal-cone tube, it is necessary to insulate the face-plate (which is made from a glass of comparatively low electrical resistance) and the lip from the panel. This involves the use of a second face-plate and the overall optical performance is correspondingly inferior to that of a display using the all-glass tube. A corollary of the insulating nature of the all-glass envelope is the opportunity of using higher final anode voltages thus enabling higher light output and better resolution to be obtained.

The problems caused by interaction between the metal cone and any environmental magnetic fields are eliminated in the all-glass tube and thus, there is no possibility of introducing a permanent magnetic field, as can happen with the metal cone. Also, it is impracticable to use pincushion correction coils with metal-cone tubes.

The all-glass envelope is intrinsically much safer than the metal-cone tube. This increased safety factor is due partly to the integral all-glass construction (which avoids metal-glass seals at areas of high mechanical stress) and partly to the type of glass used for the face-plate (since for the metal-cone tube, the face has to be made from a glass of inferior physical characteristics).

Phosphors

The 24/10 and 24/48 cathode ray tubes can be supplied with a phosphor selected from the wide range that has been evolved by Ferranti Ltd. to meet the requirements of particular applications. Examples of these applications are alpha-numeric display (requiring a low frequency anti-flicker characteristic), radar display (both long and short persistence characteristics) and television (short persistence). Other phosphors are available to meet the requirements of specialised applications such as synthetic radar and display systems using light pen feedback.

For many computer display applications it is essential that the display is not only flicker-free but also has a short decay time. The repetition frequency at which flicker disappears depends on a number of factors including the colour and brightness of the display, the duty ratio of the signal, the colour and intensity of the ambient lighting, and the individual user. Under average conditions a re-write frequency of 10 c/s is satisfactory whilst under certain conditions this frequency may be as low as 6 c/s. Ferranti anti-flicker phosphors have been developed to meet these requirements as far as possible.

Phosphors are available which enable the 24/10 and 24/48 to be used in display systems incorporating a light pen feedback network. The variation in thickness of the face-plate assembly on these tubes is sufficiently small to have a negligible effect on the output signal from the light pen to the feedback system.

Face-plate Assembly

The face-plate is fabricated from armoured glass sheet and is resin-bonded to the face of the cathode ray tube. The armoured sheet can be supplied with an etched surface that eliminates reflections from, and highlights on, the surface: in both clear and etched forms, the face-plate is spectrally neutral. A coloured dye can be introduced into the bonding resin. This results in a filter which is spectrally matched to the phosphor emission, thereby considerably enhancing the contrast.

Applications

The 24/10 and 24/48 cathode ray tubes are ideally suited for use in

ALPHA-NUMERIC DISPLAY SYSTEMS
RADAR DISPLAY SYSTEMS
TELEVISION

When used in systems where character writing is a requirement, the necessary secondary deflection can be achieved either by electromagnetic or by electrostatic means. Thus, the neck of the 24/48 tube is sufficiently long to accept a secondary deflection coil between the main deflection coil and the focus coil. Similarly, the 24/10 can be supplied with an alternative electron gun in which secondary deflector plates are incorporated.

When used in display systems where static and dynamic information is required to be presented, three methods of achieving this are possible, viz. overlay techniques, front-projection and rear-projection.

Because of the high degree of flatness of the face, it is possible to use transparent overlays applied directly on the face-plate. Thus, in radar displays, it is possible to use a map through which the dynamic radar information can be seen against the static geographic information.

As an alternative to the overlay technique, it is possible to use front-projection. In this case, the necessary static information is projected optically on to the front face of the tube. Thus in airport surveillance radar display systems, the permanent air lanes can be displayed by this method.

The third method is to use optical projection through a port in the cone of the tube on to the back of the screen. Thus, in display systems used in vehicles, a map can be projected on to the screen on which the positional information of the vehicle is displayed by normal electronic methods. At the present time, development of a 24″ bulb with a rear port is well under way and it is anticipated that the 24/10 and 24/48 cathode ray tubes with rear ports will be available in the near future.

Technical Specifications

Physical Data (both types):—

Base	BSS.448 B12A (Duodecal)
Anode Cap	BSS.448 CT8 Cavity Type (JEDEC J1-21)
Max. Overall Diameter	610mm. (24·02″)
Min. Useful Screen Diameter	514mm. (20·24″)
Max. Overall Length:	
Type 24/10 only	728mm. (28·66″)
Type 24/48 only	818mm. (32·21″)
Nominal Neck Diameter	37mm. (1·46″)
Centre of Focus to Reference Line:	
Type 24/48 only	170mm. (6·69″)
Approximate Weight	27·2 kg. (60 lbs.)

For full dimensions see drawings on pages 6 and 7.

Deflection System:—
Magnetic, scan angle = 57°.

Screens:—
All screens are aluminised.

Phosphors H4, L3 and K7 are recommended for use with these tubes and other Ferranti phosphors can be supplied on request.

Although these phosphors are more resistant to burning than earlier types, they should, nevertheless, be operated with care.

(The characteristics of phosphors H4, L3 and K7 are given on page 8).

Electrical Ratings:

	24/10 Electrostatic Tetrode			24/48 Electromagnetic Tetrode			
	Min.	Nom.	Max.	Min.	Nom.	Max.	
Heater Voltage	5·7	6·3	6·9	5·7	6·3	6·9	V
Heater Current	—	0·3	—	—	0·3	—	A
Final Anode Voltage	12	—	18	12	—	20	kV
First Anode Voltage	100	—	600	250	—	600	V
Focus Anode Voltage	–500	—	+500	—	—	—	V
V_{h-k}							
Heater Positive	—	—	200	—	—	200	V
Heater Negative	—	—	200	—	—	200	V
R_{g-k}	—	—	1·5	—	—	1·5	MΩ

Typical Operation:	24/10	24/48	
First Anode Voltage	300	300	V
Final Anode Voltage	16	17	kV
Focus Anode Voltage	±300	—	V
Vg for Visual Cut-off	–90 to –30	–150 to –60	V
Resolution*	< 1·0mm. (0·04″)	< 0·5mm. (0·02″)	

*The resolution is measured with a microscope to visual extinction. During the measurement the grid is pulsed to obtain a single line scan of 100μS duration and 50μA amplitude.

Focus Coils

For the 24/48 tube it is necessary to use a suitable coil to focus the electron beam and to obtain the optimum performance of which the tube is capable, it is essential that this focus coil is correctly aligned. The minimum figure quoted under "Typical Operation" can be achieved using either F.C.1 or F.C.19 focus coils and under the conditions given the typical resolution is 0,3 mm. (0·012″). Where the application does not demand the highest resolution, a focus coil type F.C.8 may be used. This coil is designed for use where coil alignment is not essential and under the operating conditions given above, a typical resolution of 0,6 mm. (0·024″) should be achieved.

Recommended Coil Positions:—

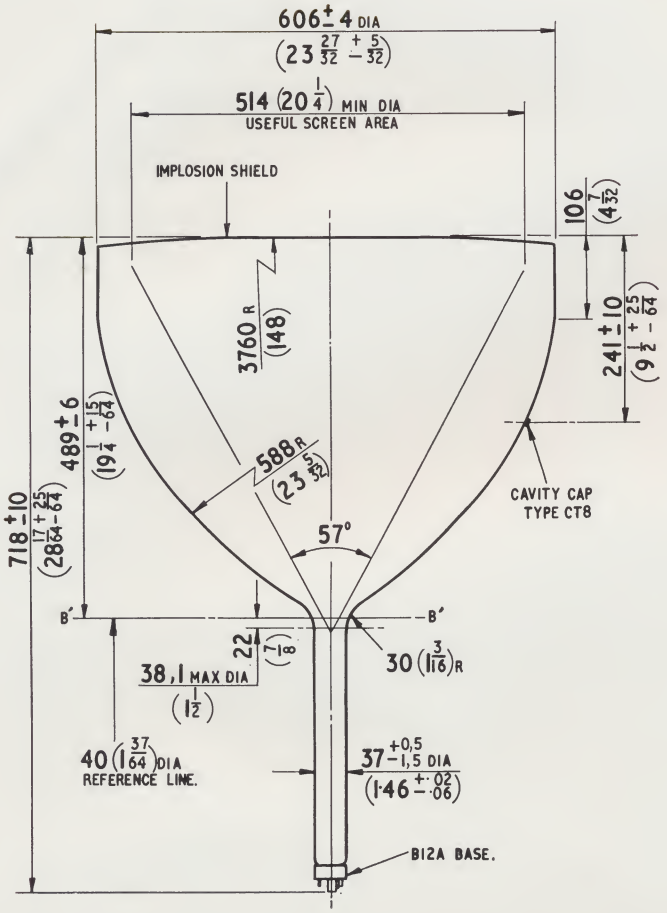
See drawings on pages 6 and 7.

Variants:—

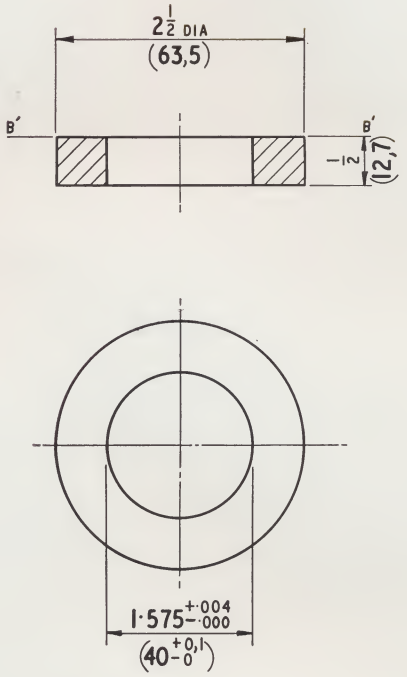
A number of different types of electron gun can be fitted to these tubes giving variations in the method of focus, resolution, overall length, etc.

X-Ray Warning

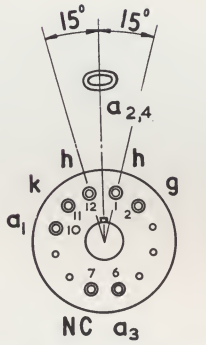
These tubes have a face-plate shield but when they are operated at a final anode voltage in excess of 16 kV, shielding of the cone and neck areas may be required to give protection against the possible danger of injury from prolonged exposure to X-Radiation at close range.



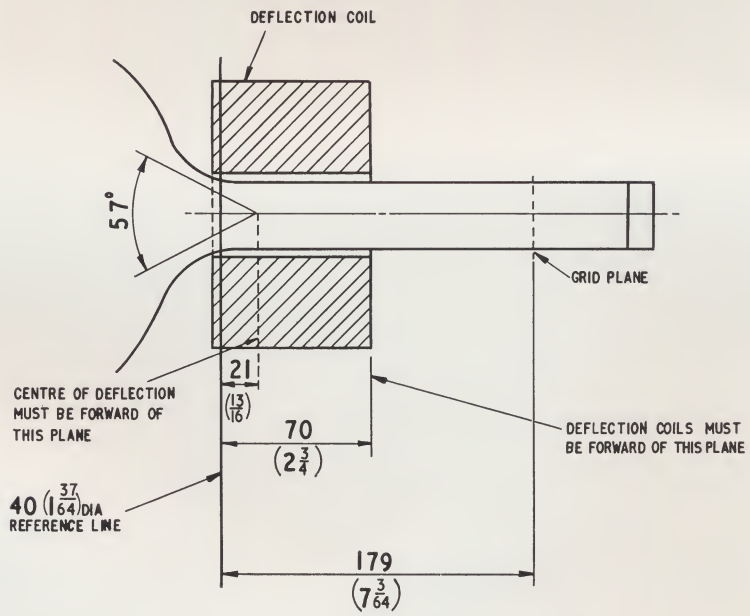
OUTLINE



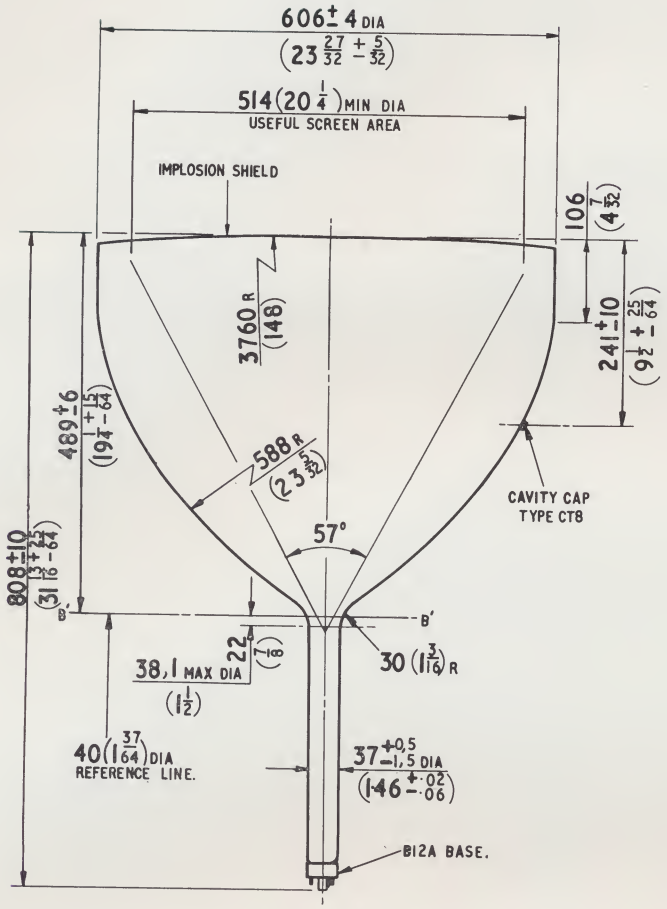
REFERENCE LINE GAUGE
(also used with 24/48 tube)



BASE CONNECTIONS



RECOMMENDED COIL POSITIONS



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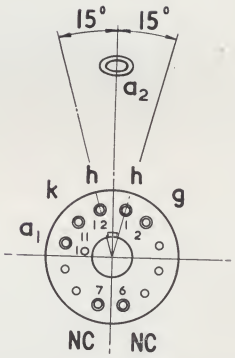

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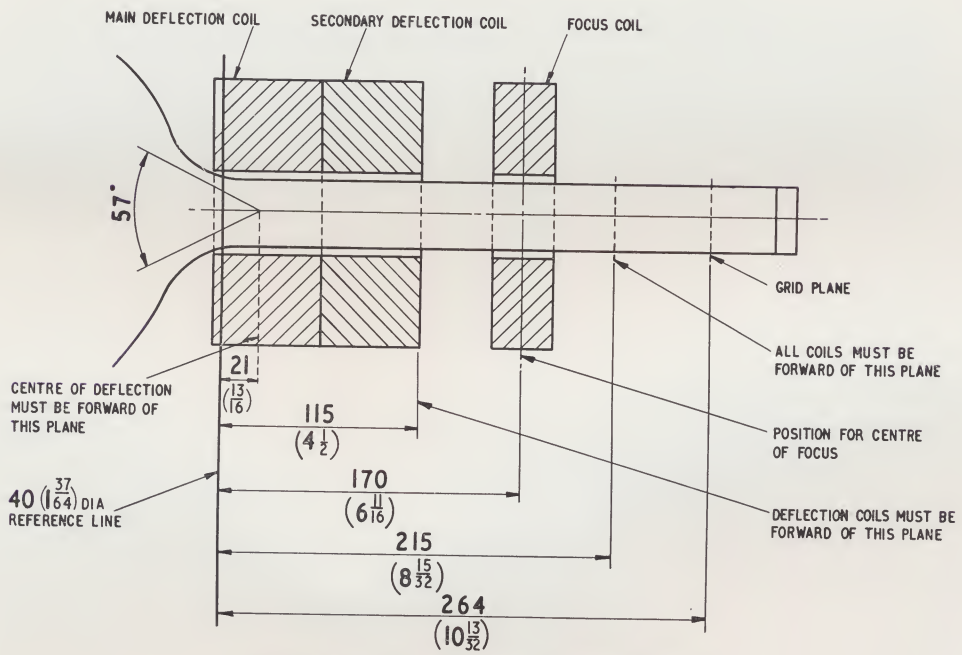
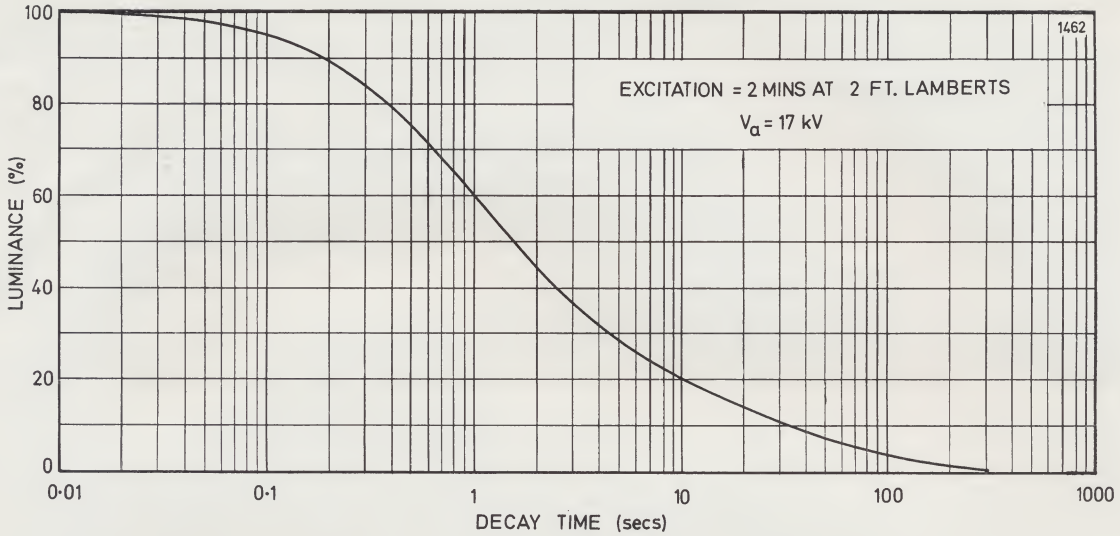


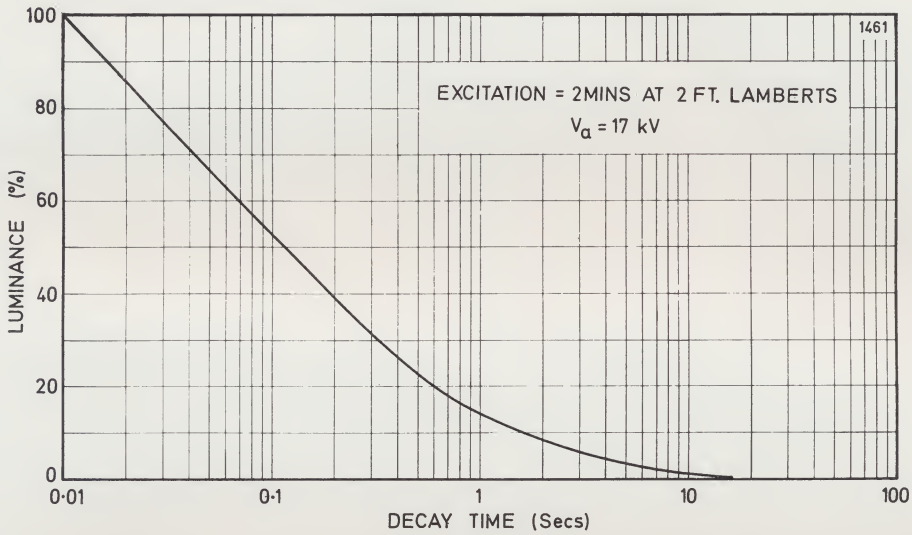
RECOMMENDED COIL POSITIONS

PHOSPHOR DATA

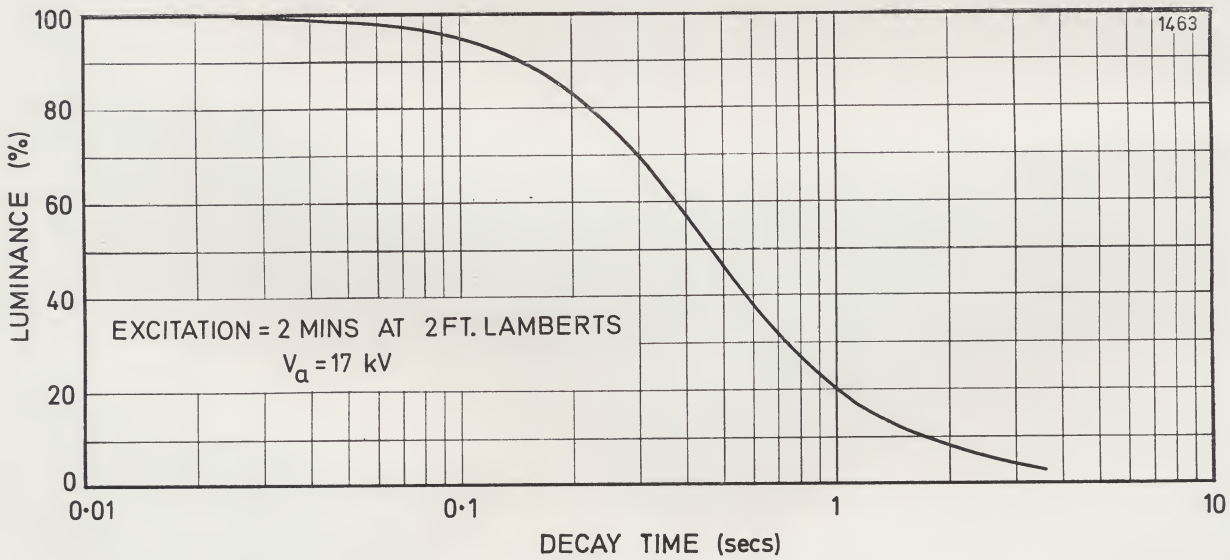
H4: This is an orange phosphor with peak emission at 5900Å. The typical persistence characteristic is given below.



K7: This is a green phosphor with peak emission at 5200Å. The typical persistence characteristic is given below.



L3: This is an orange phosphor with peak emission at 5900Å. The typical persistence characteristic is given below.



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